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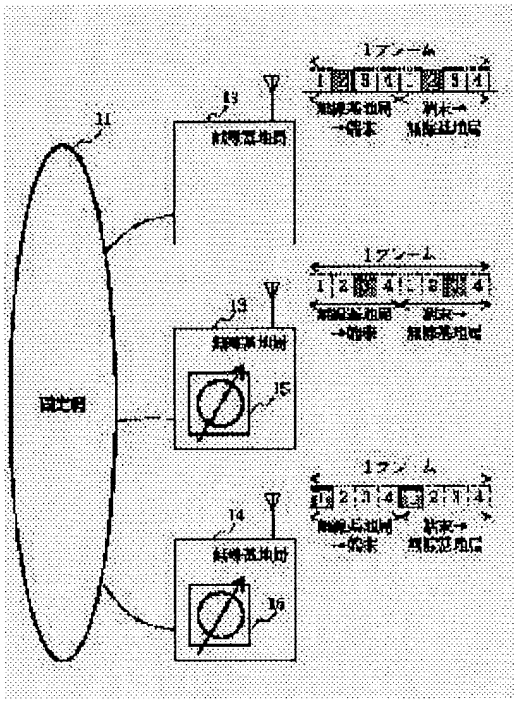
(54) RADIO COMMUNICATION EQUIPMENT

(57)Abstract:

PURPOSE: To establish frame synchronization among radio base stations for performing communication by a TDMA-TDD system.

CONSTITUTION: Information for indicating the position of a slot inside a frame is inserted to the slot of control signals transmitted from the radio base station 12. In the radio base station 13 for performing the frame synchronization, the control signal transmission timing of the present station is synchronized with the reception timing of the control signals and the frame synchronization is established corresponding to the position of the slot of the reception control signals inside the frame.



LEGAL STATUS

[Date of request for examination]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is used for a time division multiple access communication mode. It is related with the communication mode which carries out time multipled of the slot of transmission and reception by the same carrier frequency especially, i.e., a TDMA-TDD method. This invention is suitable for using for the digital cordless telephone of a multizone form.
[0002]
[Description of the Prior Art] Drawing 8 is the block block diagram showing the radio communication equipment of the conventional example of a TDMA-TDD method, and drawing 10 shows an example of the frame structure.
[0003] This radio communication equipment is equipped with the base transceiver station 82 connected to the fixed network 81, and this base transceiver station 82 communicates with two or more migration terminals and TDMA-TDD methods. One frame is constituted from the receiving slot side which carries out n piece multiplex [of the receiving slot] the transmitting slot side which carries out n piece multiplex [of the transmitting slot] by the TDMA-TDD method.
[0004] Here, the communication link between a base transceiver station 82 and the migration terminals 83 and 84 is explained. A base transceiver station 82 transmits a control signal including information required in order to perform cross connection using the 1st slot in the slot defined beforehand and this example. f1 is used as a carrier frequency of a control signal. Further, a base transceiver station 82 transmits the message signal to the migration terminal 83 by the 2nd slot, and transmits the message signal to the migration terminal 84 by the 3rd slot. A different frequency from f1 is used as a carrier frequency of a message signal. Furthermore, a message signal is transmitted using the 4th slot or subsequent ones to other migration terminals. In the migration terminals 83 and 84 and --, after the time amount beforehand defined from its receiving slot passes, a telephone signal is transmitted to a base transceiver station 82. In a base transceiver station 82, the signal from each migration terminal is received in the receiving slot location corresponding to the transmitting slot in one frame.
[0005] Although this example showed the case where the number of base transceiver stations was one, it is necessary to take the synchronization between base transceiver stations for an application which prepares two or more base transceiver stations, for example, an application like the cordless telephone of a multizone form, so that the collision of a control signal may not arise.
[0006] As an example of synchronous doubling between base transceiver stations, the example of conventional land mobile radiotelephone equipment is shown in drawing 10 . However, a TDMA method or TDD method is not used in this case, either, but the number of the radio channels which can access coincidence is one, and multiplex [of the radio channel of transmission and reception] is carried out by the frequency.
[0007] This land mobile radiotelephone equipment is equipped with the control station 102 connected to the fixed network 101, and base transceiver stations 105-107 are connected to this control station 102. The adjustable delay circuits 103 and 104 for adjusting a propagation delay are established in a control station 102. The control signal over the migration terminal 108 is sent out through base transceiver stations 105-107 from a control station 102. Using the frequency set up so that a mutual zone might not lap, base transceiver stations 105-107 synchronize mutually, and send out a control signal.
[0008] In order to synchronize a control signal, a base transceiver station 105 is made into a criteria station, the control signal from a base transceiver station 105 is received, and time difference with the transmit timing of a local station is measured in a base transceiver station 106. This measurement result

is notified to a control station 102, and the corresponding adjustable delay circuit 103 is adjusted and it is made for time difference to serve as zero in a control station 102. In a base transceiver station 107, the control signal from a base transceiver station 106 is received, time difference with the transmit timing of a local station is measured, and the result is notified to a control station 102. A control station 102 adjusts the adjustable delay circuit 104 which corresponds so that time difference may serve as zero.
[0009] Drawing 11 shows the sending-out timing of the control signal by the control station 102 and base transceiver stations 105-107. In a control station 102, a control signal is delayed by the adjustable delay circuits 103 and 104, and the timing of time of day t0-t2 sends out a control signal to base transceiver stations 105-107 by it, respectively. By passing the signal line between a control station 102 and base transceiver stations 105-107, a propagation delay arises and these control signals are transmitted to time of day t3 all at once from base transceiver stations 105-107.
[0010] Thus, the control signal transmitted from two or more base transceiver stations reaches coincidence mostly at a migration terminal, and also when passing through a boundary region between base transceiver stations where the control signal from a base transceiver station is received on this level, at a migration terminal, the phase hand's base transceiver station can be changed, maintaining the synchronous condition.
[0011]
[Problem(s) to be Solved by the Invention] When two or more base transceiver stations transmit a control signal on a mutually different frequency, the transmit timing of each office can be set up by receiving the control signal from other base transceiver stations in each base transceiver station.
[0012] However, in the case of a TDMA-TDD method, since the same frequency is used, it is necessary to transmit a control signal to the timing from which a base transceiver station differs mutually. And yet, the frame of the signal which each base transceiver station transmits and receives between migration terminals needs to synchronize between the base transceiver stations which adjoin at least. If it does not synchronize, it is because another side is received and causes degradation of communication link quality, and decline in frequency use effectiveness by interference, when one base transceiver station is transmission. Therefore, an approach like conventional land mobile radiotelephone equipment cannot be used as it is.
[0013] This invention aims at offering the radio communication equipment which can synchronize control signal transmit timing between the base transceiver stations in a TDMA-TDD method.
[0014]
[Means for Solving the Problem] The radio communication equipment of this invention is equipped with two or more base transceiver stations where a transmitting slot and a receiving slot communicate by two or more migration terminals and Time Division Multiple Accesses using the frame by which time multipled was carried out by the same carrier frequency. In the radio communication equipment with which two or more of these base transceiver stations include the means which transmits and receives the control signal over a migration terminal using at least one slot in a frame, respectively At least one base transceiver station of two or more base transceiver stations A location information means in a frame to insert the slot positional information which shows the location in the frame of the slot in the slot which transmits a control signal is included. It is characterized by having a frame synchronization means to adjust the timing of the frame which the station transmits and receives according to the receiving timing and its received slot positional information of the control signal in each base transceiver station.
[0015] It is good to set one of two or more of the base transceiver stations as a criteria station, to form the notice means of the location in a frame in all criteria stations at least depending on this criteria station and the case, and to form a frame synchronization means in all base transceiver stations other than a criteria station.
[0016] It is also possible to establish the frame synchronization of each base transceiver station in order. However, in order to establish frame synchronization, it is necessary to receive the control signal from other base transceiver stations, and the frame transmission and reception in the base transceiver station must be interrupted. Therefore, as long as it is installed within limits which a control signal reaches, it is desirable for other base transceiver stations to perform frame synchronization actuation all at once with the control signal from one base transceiver station.
[0017]
[Function] The information which shows the location in the frame of the slot is inserted in the slot of the control signal transmitted from at least one base transceiver station. In the base transceiver station which performs frame synchronization, the control signal and the information on a location are received, and the frame transceiver timing of a local station is set up with reference to the timing and its slot location

of the control signal. Thereby, the transmit timing of the control signal of the station is also set up.
[0018] Since wiring becomes complicated with a small radio communication equipment like a cordless telephone with the configuration which connects a control station between a base transceiver station and a fixed network, it is desirable to connect a base transceiver station to a fixed network according to an individual, and to amend the propagation delay between a fixed network and a base transceiver station in each base transceiver station.
[0019]
[Example] Drawing 1 is the block block diagram showing the radio communication equipment of this invention example. This example equipment is equipped with two or more base transceiver stations 12-14 where a transmitting slot and a receiving slot communicate by two or more migration terminals and Time Division Multiple Accesses using the frame by which time multipled was carried out by the same carrier frequency, and the control signal over a migration terminal is transmitted [two or more of these base transceiver stations 12-14] and received using at least one slot in a frame, respectively. Below, base transceiver stations 12-14 explain as what transmits and receives a control signal using the 2nd, 3rd, and 1st time slot, respectively.
[0020] Drawing 2 shows the example of a format of a control signal slot. This slot is constituted by the guard bit G of the 16-bit non-signal used for the 62 bits preamble PR used for establishment of the 2-bit start symbol SS and bit synchronization which are used for the 4-bit lamp bit R used for the standup of a signal, and a start bit, 32 bits unique WORD UW used for establishment of frame synchronization, 124-bit CAC for transmitting an actual control signal, and the collision prevention between time slots.
[0021] In a normal operating state, the timing of transmission and reception of a base transceiver station 12-14 synchronizes, and the control signal which base transceiver stations 12-14 transmit is not received in other base transceiver stations. However, it is necessary to synchronize the transceiver timing of base transceiver stations 13 and 14 with the transceiver timing of a base transceiver station 12 at the time of beginning of mission or other timing adjustments. For that, the function for originally receiving a control signal from a migration terminal is used, and the control signal which the base transceiver station 12 transmitted is received.
[0022] Drawing 3 is a flow chart which shows the flow of the synchronous operation in a base transceiver station 13. A base transceiver station 12 transmits the signal which shows the location in the frame of the slot the bit pattern of unique WORD UW shown in drawing 2 , or by preparing 2 bits of dedication in CAC. If this slot is received, a base transceiver station 12 will establish a bit synchronization by Preamble PR, and will establish the frame synchronization about a slot by unique WORD UW. At this time, the time difference of receiving timing and the timing to which a local station tends to transmit a control signal is measured, and first, the adjustable delay circuit 15 is adjusted so that that time difference may serve as zero. Then, the control signal received by the slot is decoded, the location in the frame of the received slot is checked, and the adjustable delay circuit 15 is again adjusted so that the time delay difference in one frame may consider as zero. Thus, after a synchronization is established, a base transceiver station 13 starts transmission of a control signal.
[0023] Similarly, a base transceiver station 14 also adjusts the adjustable delay circuit 16 according to the control signal from a base transceiver station 12, establishes frame synchronization, and starts sending out of a control signal. If the installation of a base transceiver station 14 is a location at which the control signal from a base transceiver station 12 does not arrive, frame synchronization will be established according to the control signal from a base transceiver station 13.
[0024] Drawing 4 thru/or drawing 7 show an example of operation. Drawing 4 shows the condition before frame synchronization is established. In this condition, transmission of a base transceiver station 12 and reception of base transceiver stations 13 and 14 may lap, or a control signal may collide. Then, first, as shown in drawing 5 , the timing of control signal transmission of a local station (this example base transceiver station 13) is synchronized with the receiving timing of the control signal from other base transceiver stations (this example base transceiver station 12). Then, based on the location in the frame of the slot shown with the control signal, the timing of the frame which a local station transmits and receives is adjusted so that the slot of the same number may synchronize. Drawing 6 shows a base transceiver station 12 and the condition that frame synchronization was established among 13, and drawing 7 shows the condition that frame synchronization was established in all the base transceiver stations 12-14.
[0025] Although other base transceiver stations 13 and 14 showed the configuration of the base transceiver station 12 used as a criteria station as another thing in the above example, it comes out to use the thing of the same configuration generally.

[0026]
[Effect of the Invention] As explained above, the radio communication equipment of this invention can establish frame synchronization between the base transceiver stations in a TDMA-TDD method by inserting the information about the location within the frame in the slot of the control signal transmitted from at least one base transceiver station. Therefore, when one base transceiver station is transmission, another side is also transmitted, and when one base transceiver station is reception, another side can also be received, can raise communication link quality, and, moreover, can raise a frequency ratio of consumed water.

[Translation done.]

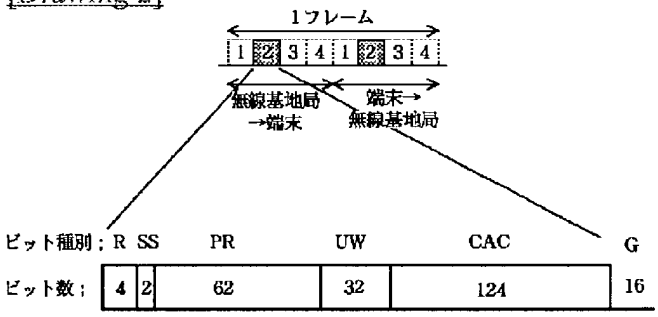
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block block diagram showing the radio communication equipment of this invention example.
[Drawing 2] Drawing showing the example of a format of a control signal slot.
[Drawing 3] The flow chart which shows the flow of the synchronous operation in one base transceiver station.
[Drawing 4] Drawing in which being drawing showing an example of operation, and showing the condition before frame synchronization is established.
[Drawing 5] Drawing showing the condition that are drawing showing an example of operation, and the timing of a control signal synchronized.
[Drawing 6] Drawing showing the condition that frame synchronization was established between two base transceiver stations.
[Drawing 7] Drawing showing the condition that frame synchronization was established in all base transceiver stations.
[Drawing 8] The block block diagram showing the radio communication equipment of the conventional example of a TDMA-TDD method.
[Drawing 9] Drawing showing a frame structure.
[Drawing 10] Drawing which is a block block diagram showing conventional land mobile radiotelephone equipment, and explains synchronous doubling between the base transceiver station.
[Drawing 11] Drawing showing the sending-out timing of the control signal by the control station and the base transceiver station.
[Description of Notations]
11 81,101 Fixed network
12-14, 82,105-107 Base transceiver station
15 16,103,104 Adjustable delay circuit
83 84,108 Migration terminal
102 Control Station

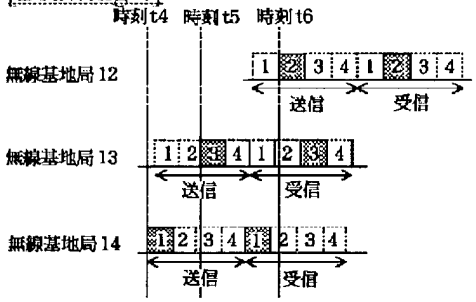
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

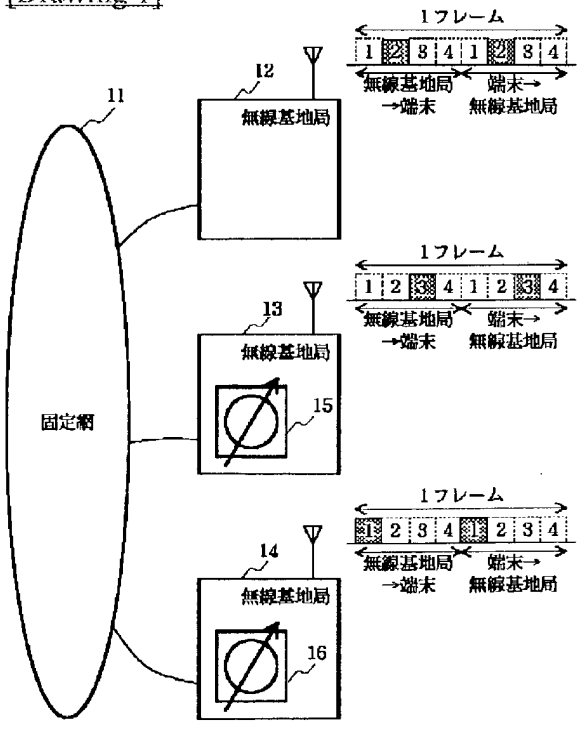
[Drawing 2]



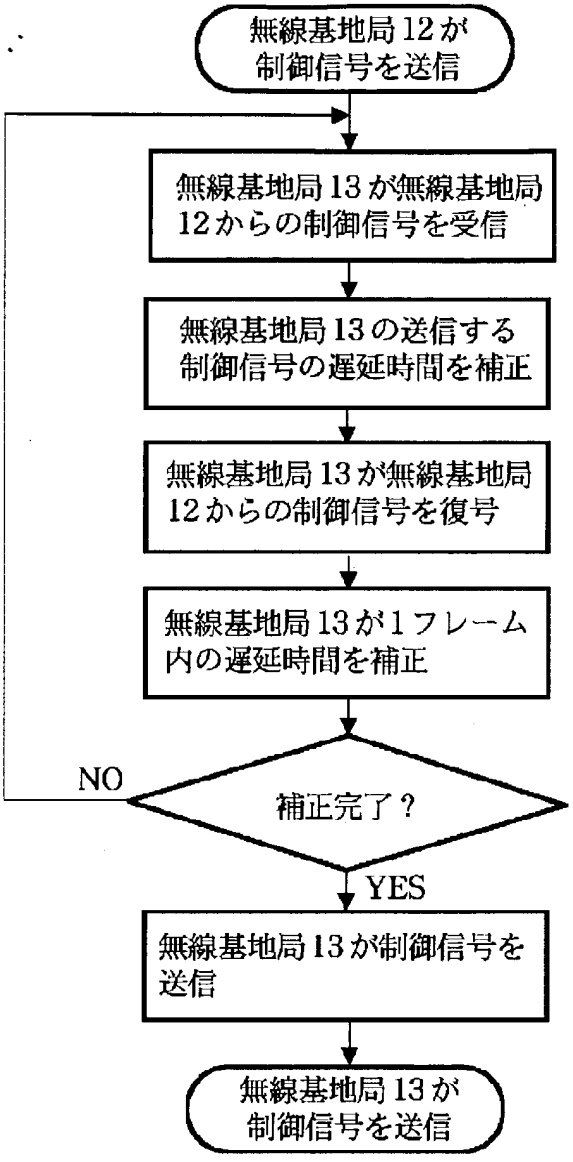
[Drawing 4]



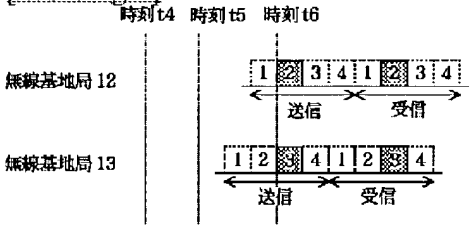
[Drawing 1]



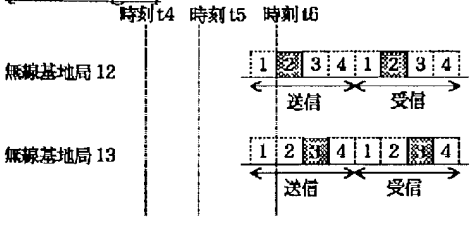
[Drawing 3]



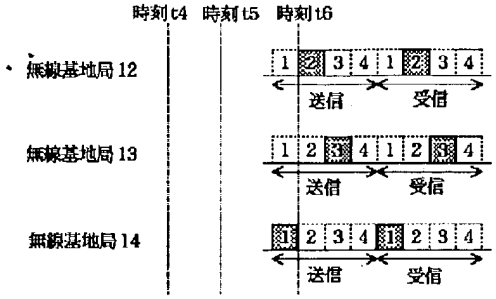
[Drawing 5]



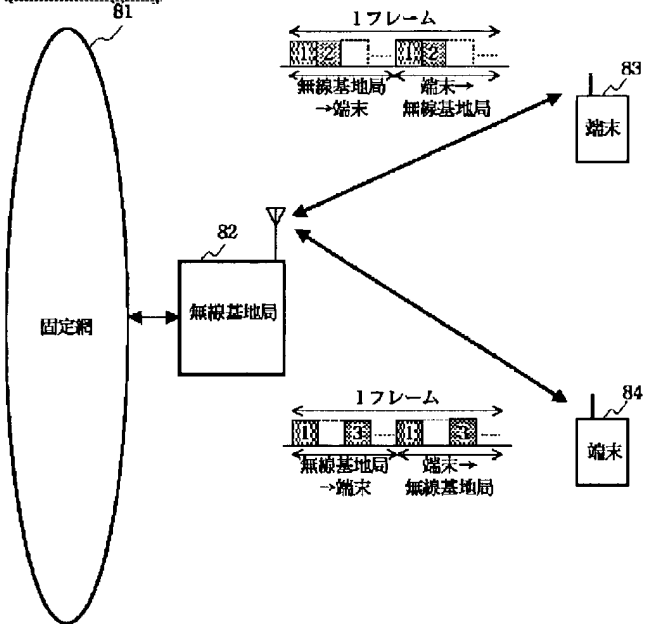
[Drawing 6]



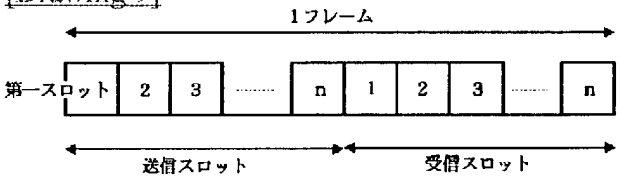
[Drawing 7]



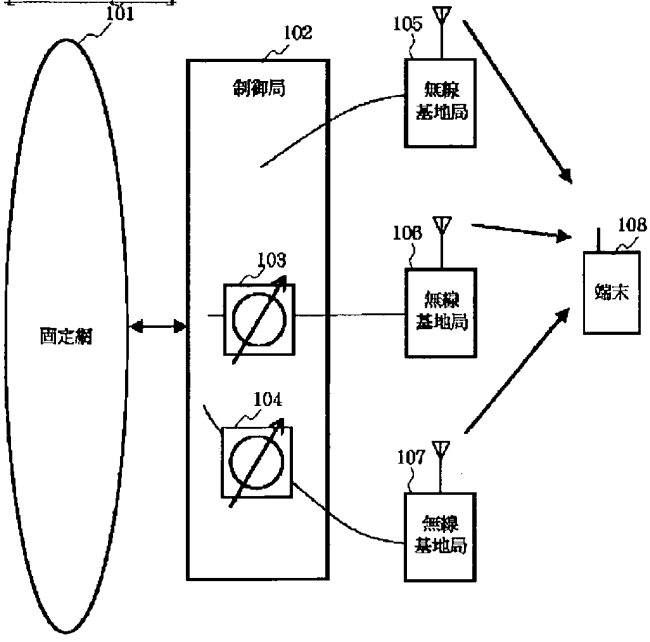
[Drawing 8]



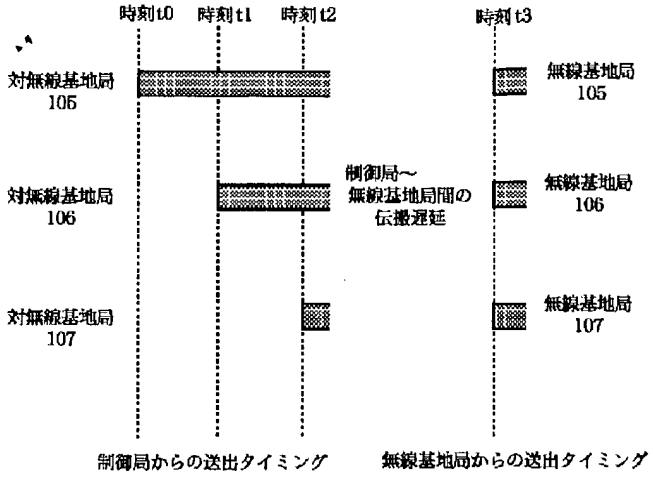
[Drawing 9]



[Drawing 10]



[Drawing 11]



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